Small Business Innovation Research/Small Business Tech Transfer

Deployable, Compact Composite Radiators for Surface Power Generation, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

To enable the use of kilowatt class Fission Power Systems for surface missions to the moon and Mars Roccor proposes the development of a flat, titanium/water heat pipe with an integrated deployable composite radiator. The proposed design leverages Roccor's experience in high strain composite deployable structures and two-phase thermal management products for spacecraft applications. Heat pipes currently provide a highly conductive passive heat transfer solution, but traditional heat pipes are cumbersome to interface to the Stirling engine and radiator panels and difficult to bend to proper configurations. While the current state-of-art is able to handle the heat load, NASA has identified deployability and thermal interfaces as focus areas for future thermal radiators. Roccor proposes to utilize their FlexCool thin flat heat pipes coupled with ROCool flexible conductive materials (k>1,000 W/m-K), and with enough strain energy to passively deploy a novel integrated Kilopower radiator.

Roccor's thin, flat FlexCool heat pipes can interface to flat surface with low thermal resistance, provide improved radiator fin efficiency, and are simple to bend. FlexCool will also be coupled with ROCool highly conductive (k>1,000 W/m-K) flexible blanket materials that uses proprietary processes to laminate pyrolytic graphite into a composite radiator material

The overarching Phase I objective is to demonstrate the technical feasibility of the proposed heat pipe/radiator, and conduct a preliminary design-analysis-fabrication loop for a 200-watt panel capable of meeting the requirements for Sunpower's current 80W Stirling engine technology. The maturation of this technology would enable the use of fission power systems larger than 1 kWe which would enhance current mission capabilities.

Anticipated Benefits

While future deep space science missions may utilize technologies developed under the Kilopower program, Human Space Exploration is the primary target. Building the foundation for human missions to Mars falls under one of the 4 top priorities for Johnson Space Center. Roccor will maintain constant engagement with all NASA centers in order to identify un-manned missions with thermal bottlenecks, which could benefit from having additional power dissipation capabilities through extended surfaces.

The most prevalent applications with future commercial partners include internet from space constellations and Earth imaging. Roccor is currently the provided for the Solar Array Deployment System (SADS) for the largest commercial satellite procurement in history and plans to add thermal management to its suite of solutions for spacecraft customers. Electronics cooling is a large commercial and defense market that could benefit from high conductivity materials developed under the program.

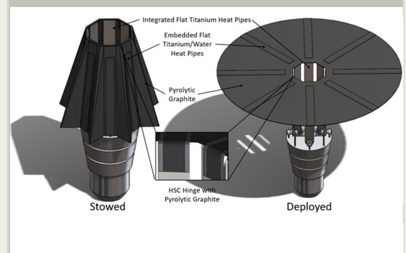

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Table of Contents

Project Introduction 1
Anticipated Benefits 1
Primary U.S. Work Locations and Key Partners 2
Project Transitions 2
Organizational Responsibility 2
Project Management 2
Technology Maturity (TRL) 2
Images 3
Technology Areas 3
Target Destinations 3

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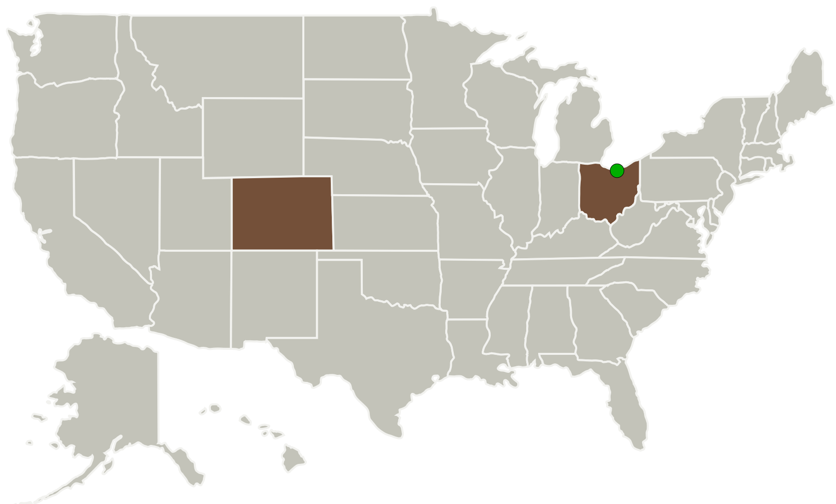
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Roccor, LLC	Lead Organization	Industry	Longmont, Colorado
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Colorado	Ohio

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/141005)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Roccor, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

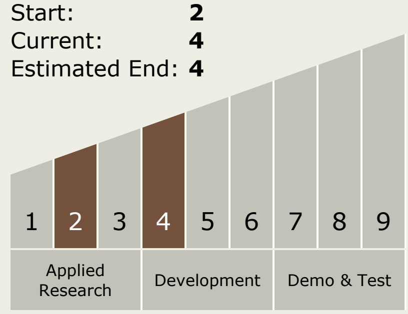
Carlos Torrez

Principal Investigator:

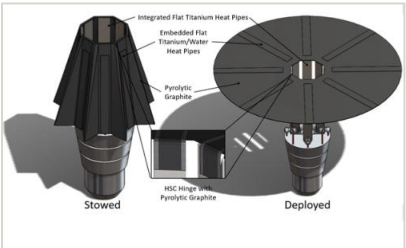
Michael Hulse

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Images



Briefing Chart Image
Deployable, Compact Composite Radiators for Surface Power Generation, Phase I
(https://techport.nasa.gov/image/131274)

Final Summary Chart Image
Deployable, Compact Composite Radiators for Surface Power Generation, Phase I
(https://techport.nasa.gov/image/133597)

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  └ TX03.1 Power Generation and Energy Conversion
    └ TX03.1.2 Heat Sources

Target Destinations

The Moon, Mars